Distributed Generation Applications and Products

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Introduction

- DG Overview and Market Development
- Alpha Group & DG Vision
- Today's DG
  - Technologies & applications
  - State & local programs
- Tomorrow's DG
  - Technologies & applications
  - Demonstration projects
- Conclusions & Call to Action

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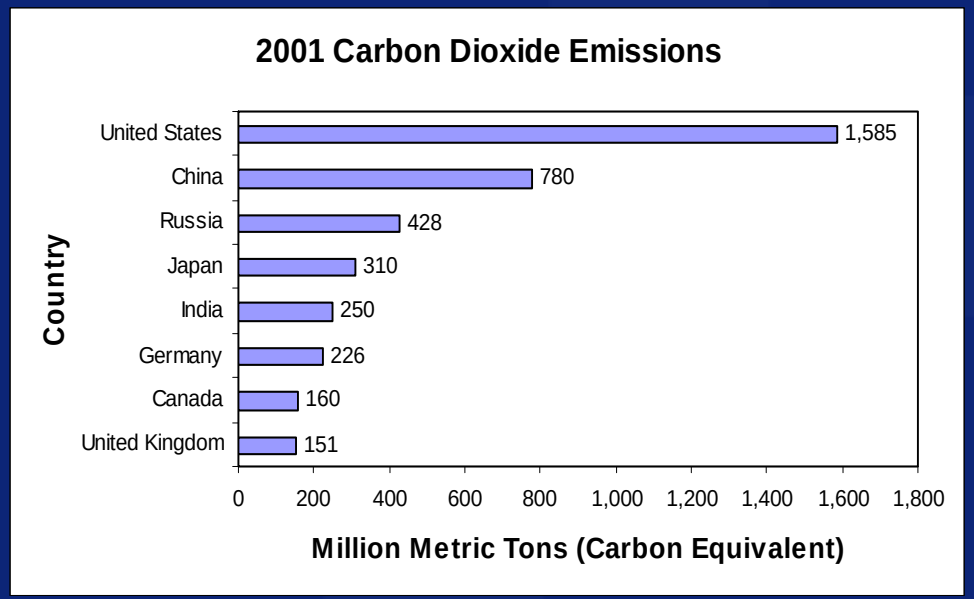
National Energy Trends

- Technological shifts to decentralized generation
  - Increased Energy Security Concerns
  - Energy & economic efficiencies (i.e., less risk)
  - Mitigate environmental concerns over local and global pollution
- Regulatory and public policy support for clean energy
- Restructuring of the electric power industry
- Digitization and globalization of the economy

Obligation to Seek Sustainable Solutions

- In 2001, global emissions of carbon dioxide from fossil fuels was 6.4 billion metric tons (carbon equivalent).
- With only 5% of the global population, the US emitted 25% of the global CO_2 emissions, or 1.5 billion metric tons.
- China's emissions are projected to increase to 1,692 MMTC by 2020, which represents an average annual increase of ~5%.



The US is the largest source of CO_2, which is the most significant greenhouse gas - and the one most closely tied to energy use

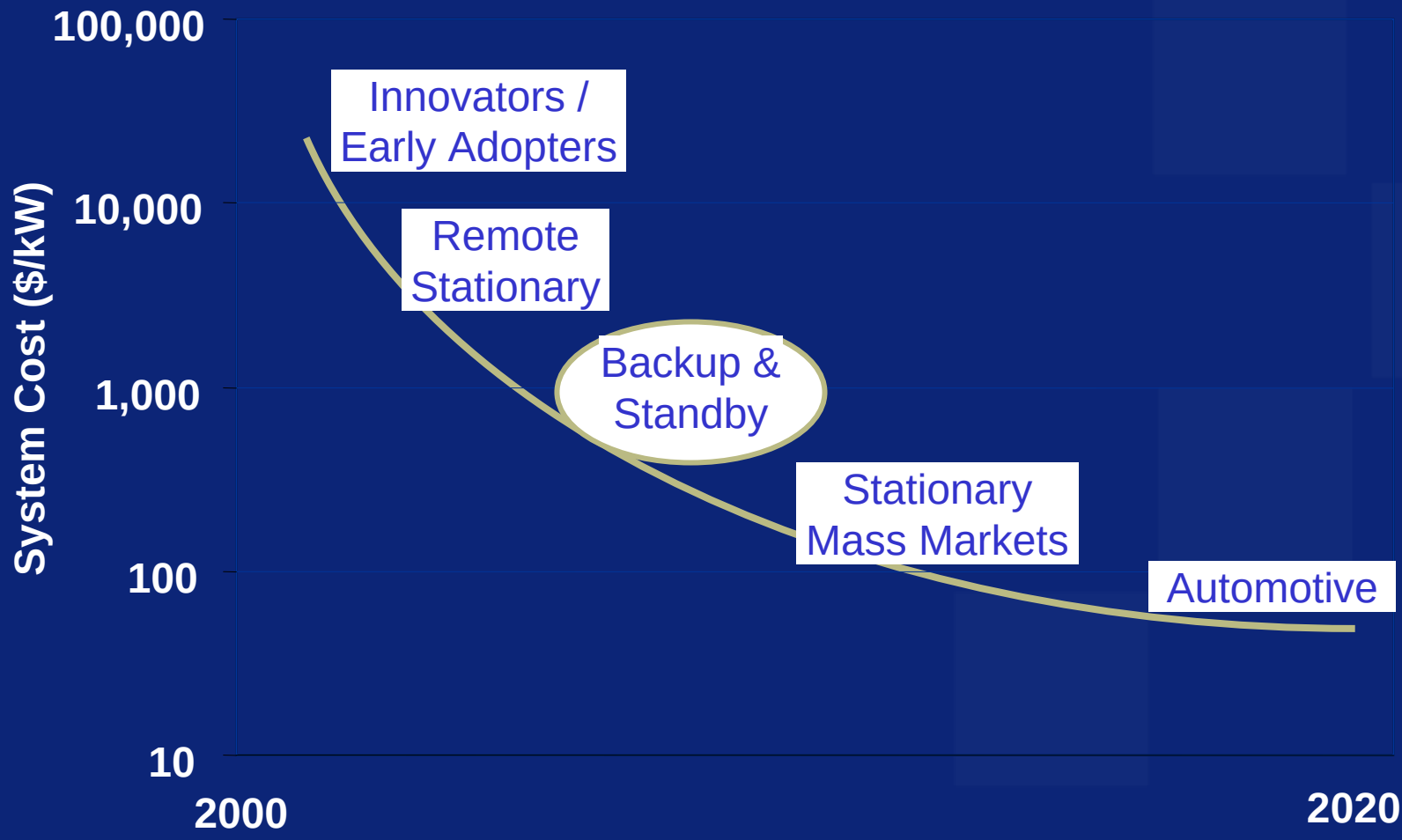
Source: EIA Statistics

Distributed Generation

- DG is an incremental approach to the centralized power grid:
  - Not “all or nothing” but it will be a mosaic approach
  - Allows incremental investment over time
  - Allows targeting of higher value sectors first (e.g., government & commercial then residential)

Emerging Technologies

Market Development



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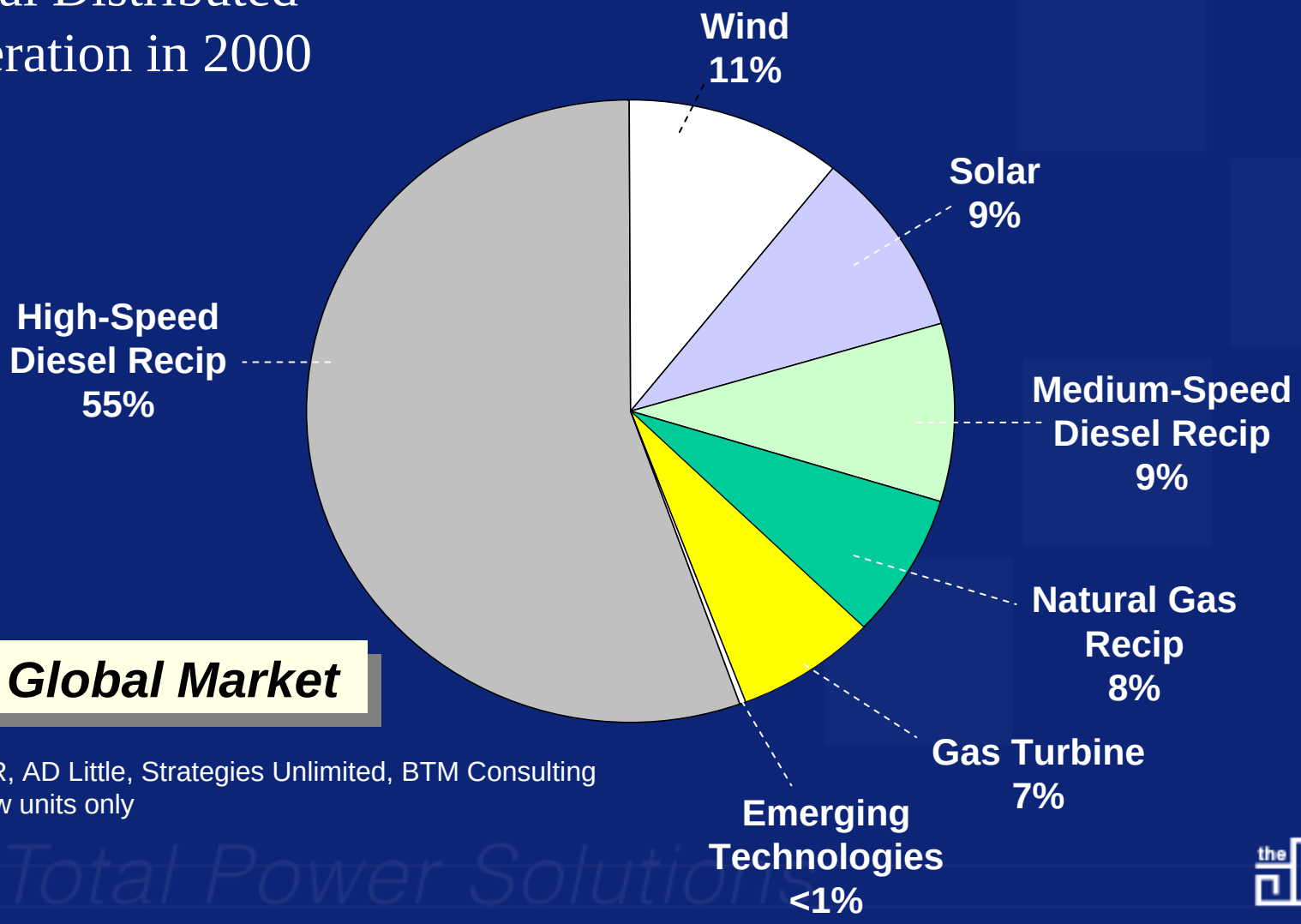
Distributed Generation

Global Distributed Generation in 2000



$27B Global Market

Source: PSR, AD Little, Strategies Unlimited, BTM Consulting
* Global, new units only

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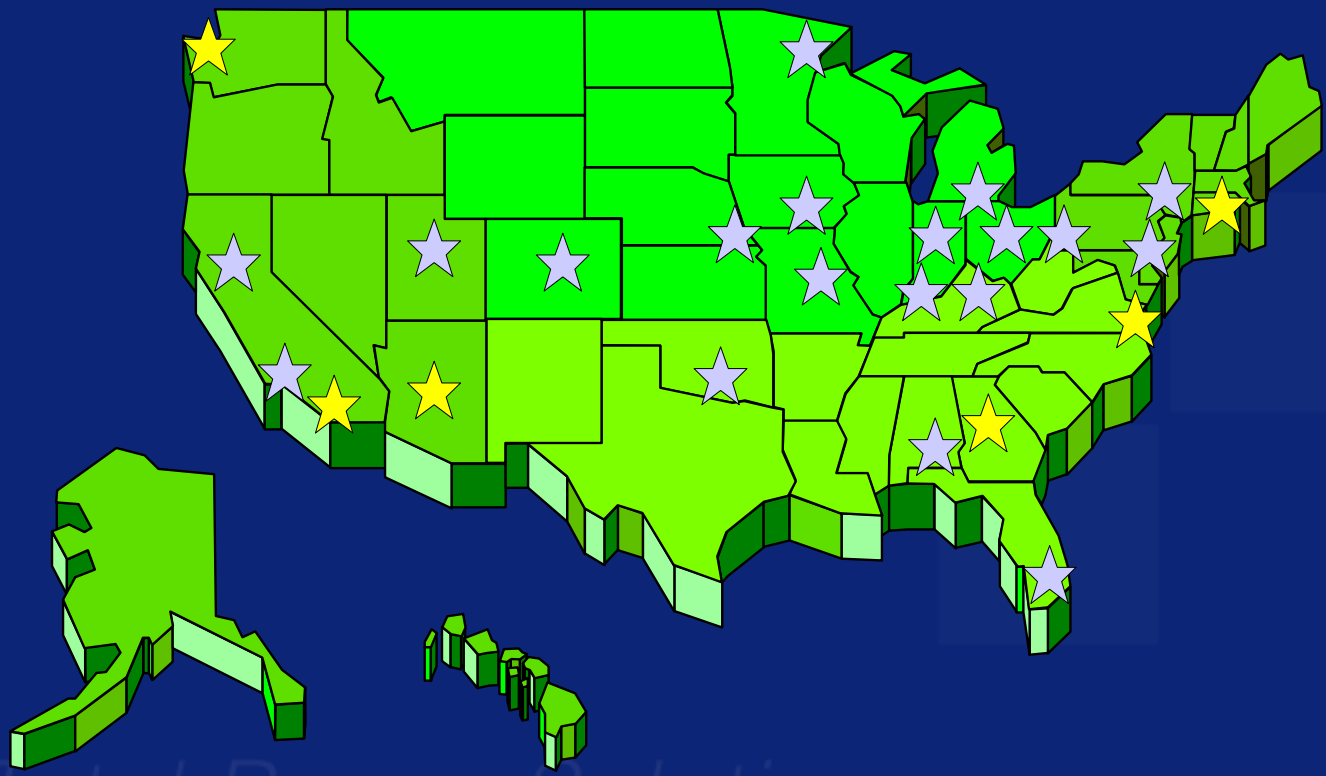
Worldwide leader in CATV, telecommunications, broadband power applications

ALPHA Generators Deployed

- Over 10,000 systems deployed nationwide into CATV network
- 100 MW DG capacity installed
- Field proven, safe, reliable service



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Alpha’s vision: replace generators & batteries w/ PV & fuel cells

Altair Energy
Background

- Founded in 1998, based in Golden, CO
- Principals in PV industry for over 20 years
- Systems design, engineering, sales
- Acquired by Alpha Technologies in 2002 for new “DG division”
- Active in 12 States w/ over 1.5 MW grid-tied PV installed
- Rapid growth: 2004 sales will exceed previous 5-year total!

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Today's Distributed Generation

PV for Homes & Schools

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Today's Distributed Generation

PV for Builders & Businesses

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Today's Distributed Generation

PV for Remote Sites

- Telecommunications
- Cellular Extenders
- Wireless Data
- RTU/SCADA
- Microwave Repeaters
- Flow Monitoring
- Catholic Protection
- Security Lighting

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Today's Distributed Generation

State Incentives - California Case Study

- "RPS" created in 1998 as part of deregulation
  - Small fraction of each kWh purchased set aside as state rebates for PV project development
  - Two rebate funds: <30 kWac (CEC); >30kWac (CPUC)
- Program growing today (despite dramatic CA budget cuts) due to enormous success
  - CEC "residential" installs @ 30+ MW to date
  - CPUC "commercial" installs @ 80+ MW to date
- Bipartisan support for program:

California Governor Arnold Schwarzenegger in his State of the State Address: "….I am going to encourage builders to build homes using partial solar power…..I intend to show the world that economic growth and the environment can coexist."

Today's Distributed Generation

State Incentives – New Jersey Case Study

- New Jersey, you say?
- NJ has 10% less solar annually than Colorado (but 10% more than Japan & Germany)
- Most aggressive RPS in nation
  - Signed to law by Board of Public Utilities in March 2004
  - 90 MW solar installed by 2008
  - "RPS is a cost-effective way of supporting the renewable energy market" (Jeanne Fox, President, NJBPU)
- State rebates offered as financial incentive to project development

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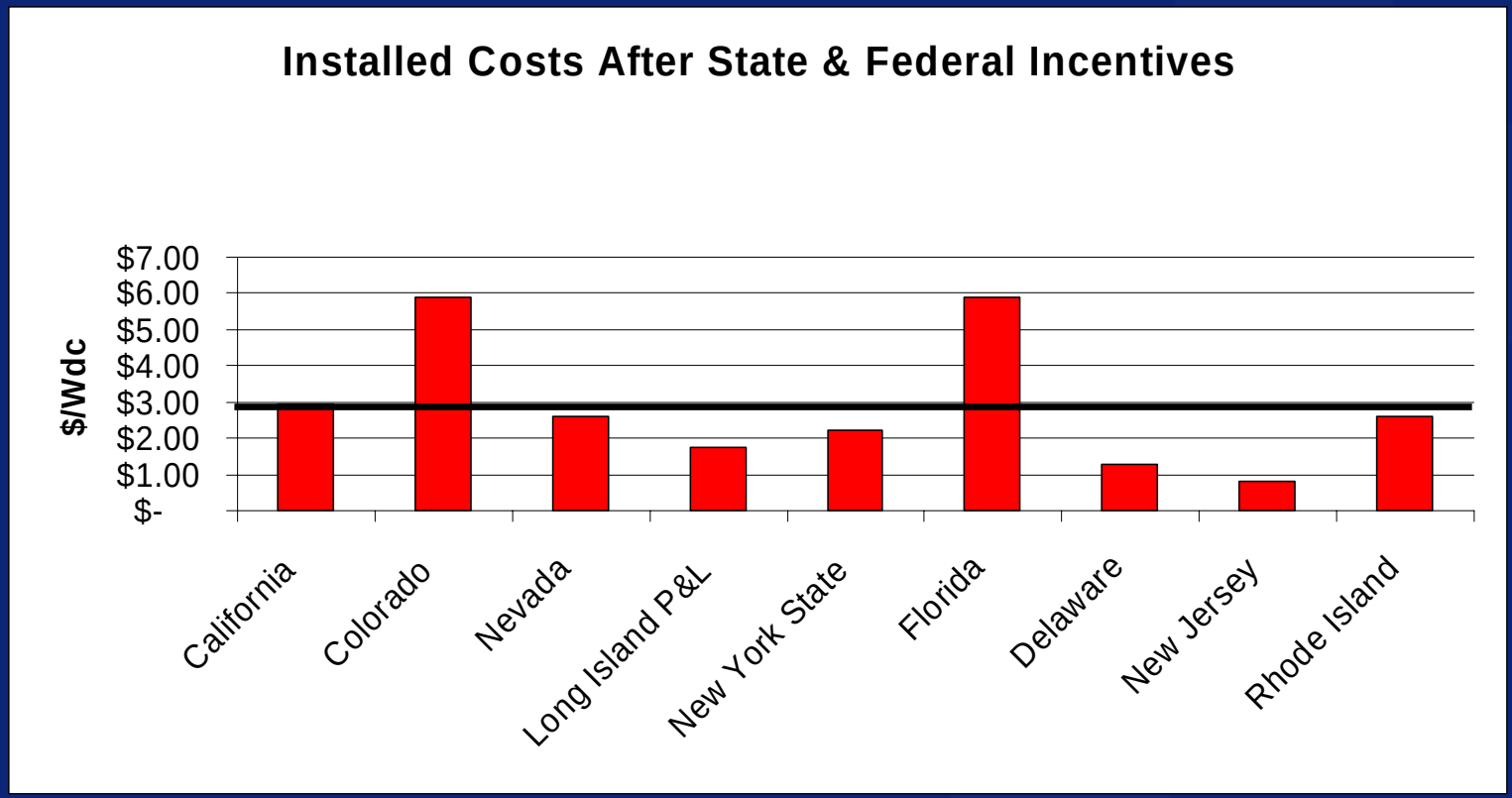
State Incentives



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Local Incentives – San Diego Case Study

- San Diego City Council – Local "RPS"
  - 50 MW Renewables installed by 2013
  - Electricity for 51,000 homes
- Numerous stakeholders involved….
  - Politicians
  - City planners
  - Utilities
  - Builders/developers
  - PV service providers

Today's Distributed Generation

Local Incentives – San Diego Case Study

- "Fast-tracked permitting" increases "PV value"
- New construction lowers installation costs 10-15%
- Altair Energy: 180 kW installed; 600 kW contracted (homes, condos, apartment buildings, etc.)

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Tomorrow's Distributed Generation

H2-Direct Fuel Cells for Remote Sites

Sprint PCS – Tucson, AZ

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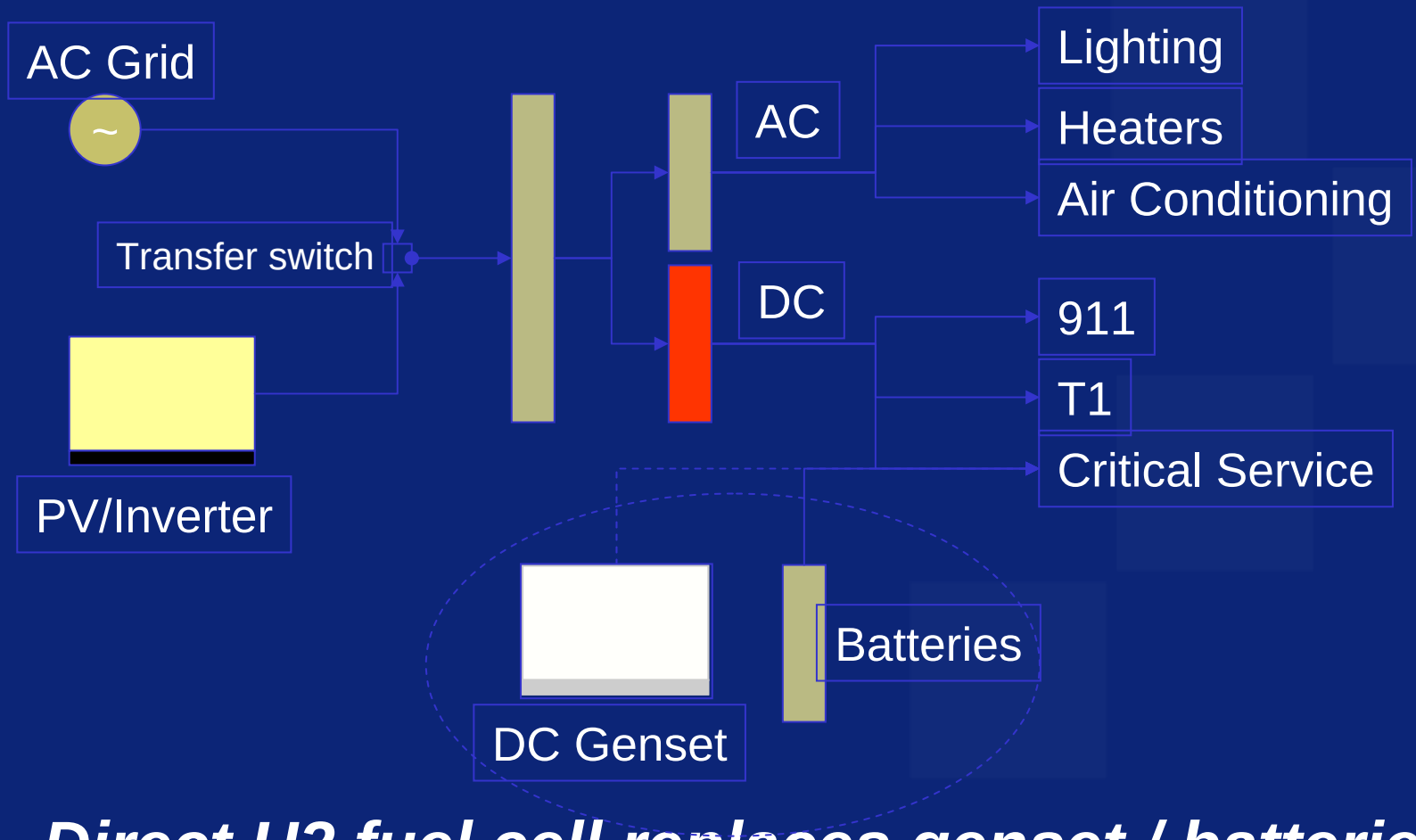
Tomorrow's Distributed Generation

H2-Direct Fuel Cells for Remote Sites



Direct H2 fuel cell replaces genset / batteries

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Tomorrow's Distributed Generation

H2-Direct Fuel Cells for Remote Sites

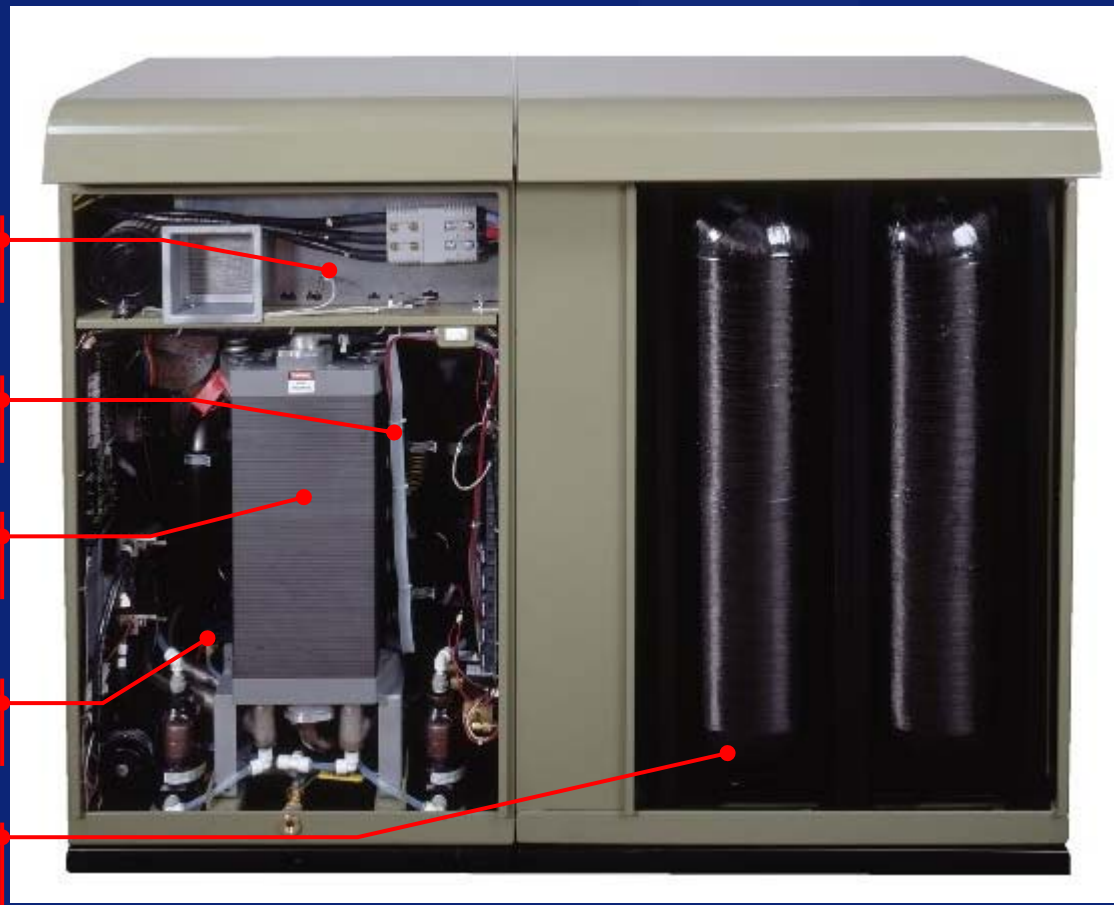
-48V DC Converter
(Adjust -46Vdc to -56Vdc)

Cell Voltage Monitoring

5kW Fuel Cell Stack

-40C Cold Start Kit

Hydrogen Fuel Storage



(shown with composite tank Storage option)

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Tomorrow's Distributed Generation

Fuel Cells for Homes & Businesses

- Demonstration sponsored by Colorado OEMC & Xcel Energy
- Initiated as Parade of Homes demo
- Operated at Washington Park Fire Station since 11/02
- Capital & operating costs high but declining

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Tomorrow's Distributed Generation

Fuel Cells for Homes & Businesses

Fuel

Air

Water

AC Power

Heat

Fuel Processor

Power Generation

Inverter

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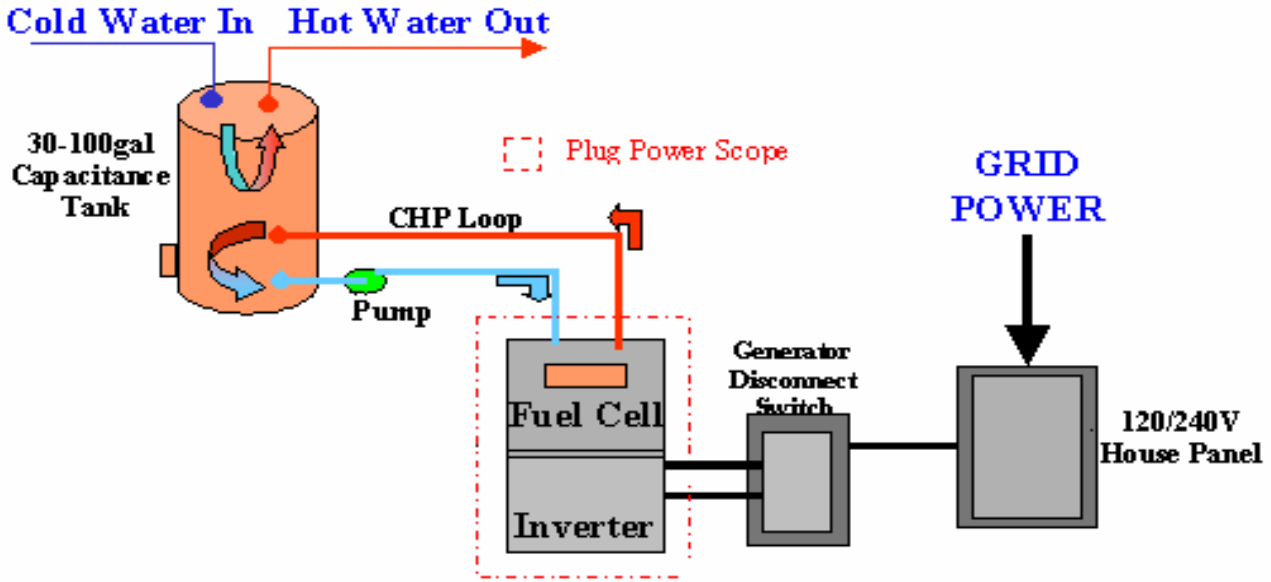
Tomorrow's Distributed Generation

Fuel Cells for Homes & Businesses



Heating / CHP Specifications	
Power Setpoint	Thermal Energy
2.5 KWe	7,880 BTU/hr
4 KWe	16,400 BTU/hr
5 KWe	19,250 BTU/hr

Note: CHP specifications are based on the published overall efficiencies of 50%/55%/50% @ 2.5kWe/4.0kWe/5.0kWe set-points respectively.

Conclusions

- DG w/ renewable technologies is taking hold and thriving in many parts of U.S.!
- Economic development often follows political, governmental, regulatory leadership
  - New businesses form
  - Jobs are created
- State & local leadership required to initiate sustainable DG initiatives

Call to Action
Think Globally, Act Locally

- Encourage Colorado's legislative, governmental, and regulatory leadership to seek sustainable solutions!
  - Renewable portfolio standards
  - State DG tax & rebate incentives
  - Legislated net metering (i.e, retail credit)
- "Subsidies" are the initial fuel required for the DG engine to start in Colorado

Seek Sustainable Solutions

People

Planet

Profit

Balancing these 3 elements can drive sustainable solutions in Colorado